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# Preliminary Results from Sediment Sampling of the R. V. *Tansei-maru* Cruise KT01-14 in the Southwestern Marginal Part of the Okhotsk Sea and the Northeastern Marginal Part of the Japan Sea

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## 1. INTRODUCTION AND PURPOSE OF CRUISE

Marine geology and micropalaeontology were investigated in the southwestern marginal part of the Okhotsk Sea off Abashiri, Hokkaido and the northeastern marginal part of the Japan Sea off Shakotan, Hokkaido from the 17th to 24th of September 2001 during the R. V. *Tansei-maru* cruise KT01-14 as parts in a series on pursuing time-spatial distribution of depositional facies and spatial distribution of present micro-organisms in the Japan Sea. This article reports the results of sediment sampling and onboard observation of the samples during the cruise. Sedimentological and micropalaeontological analyses in the laboratory of them will be published elsewhere.

Many geological, geophysical and micropalae-ontological studies have been made in the Japan Sea mainly by the Hydrographic Department, M.S.A., Japan (*e. g.* Iwabuchi, 1968), the Geological Survey of Japan / AIST (*e. g.* Arita and Okamura, 1989; Ikehara and Okamura, 1999, 2000), Ocean Research Institute, the University of Tokyo (*e. g.*, Kobayashi ed., 1984), the DSDP / ODP (*e. g.* Ingle *et al.*, 1990) and others (*e. g.* Oba *et al.*, 1991; Tsukawaki *et al.*, 2000, 2001, 2002). However, these studies in the southwestern part of the Okhotsk Sea have started recently by the Geological Survey of Japan / AIST (*e. g.* Ikehara, 2001, 2002).

Taking these previous studies into account, piston coring and grab surface sampling sites were selected mainly in; (1) the continental shelf off Abashiri and the southern slope of the Kurile Basin in the southwestern marginal part of the Okhotsk Sea, and (2) the continental shelf off Shakotan and the southern slope of the Ishikari Basin in the northeastern marginal part of the Japan Sea for the purposes of the following scientific searching; (1) spatial distribution of bottom surface sediments and micro-organisms in both areas, and (2) palaeoclimatic and palaeoenvironmental changes of the southwestern marginal part of the Okhotsk Sea (Fig. 1).

## 2. SAMPLING METHODS

A six-metres-long stainless-steel pipe piston core samplers with a 600 kg weight and a 70-cm-long Nasu type pilot core sampler were utilized to obtain cored sediments, and an Okean type grab sampler with

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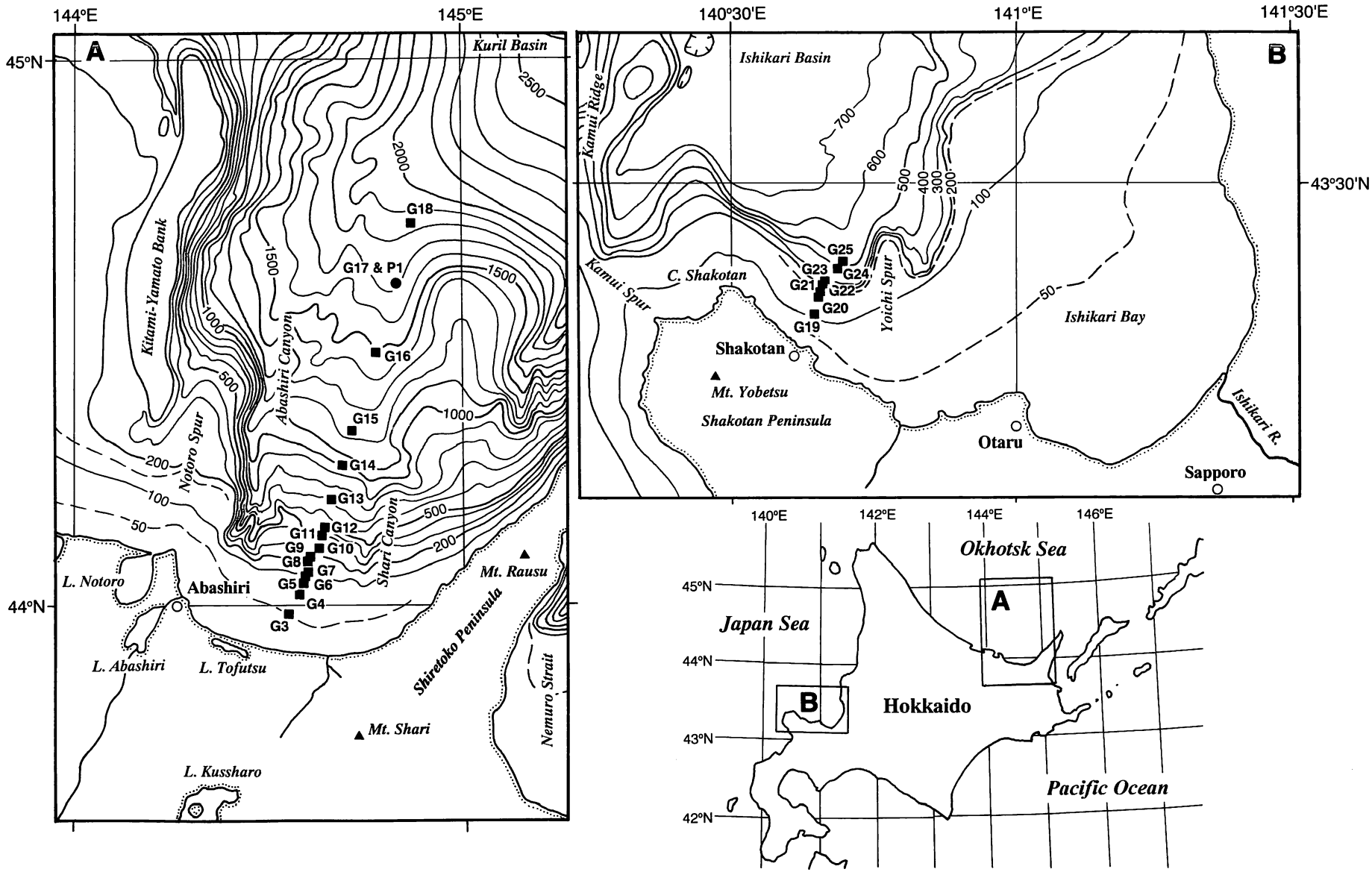


Fig. 1: Submarine topography of the studied areas in the southwestern part of the Okhotsk Sea off Abashiri, Hokkaido (A), and the northeastern marginal part of the Japan Sea northeast off Shakotan, Hokkaido (B) (solid circle: grab surface sampling site, solid square: both grab surface and piston coring site, based on Hydrographic Department, M. S. A., Japan, 1980).

extra weights were used to obtain bottom surface sediments and benthic organisms during the cruise.

## 3. TOPOGRAPHY OF THE SURVEY AREAS

The surface sediment sampling line in the southwestern marginal part of the Okhotsk Sea starts from the coastal area to the east of Abashiri to the middle slope of the Kurile Basin north-northeastward (Fig. 1A). The Shiretoko Peninsula and the Kitami-Yamato Bank, less than 200 m in depth, are situated to the east and west off the line, respectively, and the sea area along the line deepens gently north-northwestwards to the Kurile Basin. The western slope of the area is steep, but its eastern slope is rather gentle. The Abashiri and Shari Submarine Canyons cut the southern slope. A narrow continental shelf is present along the coast.

On the other hand, the line in the northeastern marginal part of the Japan Sea is located north-northeast off Shakotan in the Shakotan Peninsula (Fig. 1B). The Yoichi Spur and a topographic high that is a northward extension of the Cape Shakotan are situated to the east and west of the line, respectively. The upper continental slope of the Ishikari Basin is very steep, and it is followed by rather gentle middle slope which grades into the basin floor. The continental shelf is narrow around the peninsula, although the wide and shallow Ishikari Bay is situated to the east.

## 4. RESULTS OF SEDIMENT SAMPLINGS AND ONBOARD OBSERVATION OF SEDIMENTS

One piston cored sediments from one site and 16 grab surface sediments were successfully obtained from the southwestern marginal part of the Okhotsk Sea off Abashiri, and seven grab surface sediments were recovered from the northeastern marginal part of the Japan Sea off Shakotan (Table 1).

### 1. Continental Shelf and Slope area in the Southwestern Okhotsk Sea off Abashiri

Surface sediments of the inner continental shelf north-northwest off Abashiri in the southwestern marginal part of the Okhotsk Sea consist of mollus can shell- and gravel-bearing coarse- to very coarse-grained sand at the shallowest site G-3 at a water depth of 49 m (Plate 1, fig. 1), and molluscan shells-, shell fragments- and pebble-gravel-bearing medium- to coarse-grained sand at the sites G-4, -5, and -6 at water depths of 72, 99 and 127 m, respectively (Plate 1, figs. 2, 3 and 4). On the other hand, pumiceous and/or scoriaceous medium-grained sand is found at the sites G-7 and -8 in the outer shelf area at water depths of 142 and 174 m (Plate 1, fig. 5). The surface sediments at the site G-9, 193 m deep, and G-10, 250 m deep, from the shelf edge area are composed of scoriaceous and/or pumiceous pale olive grey fine- to medium-grained sand and scoriaceous pale olive grey muddy sand, respectively (Plate 1, fig. 6). Olive grey homogeneous sandy mud are distributed in the upper slope area at the site G-11 and -12 at water depths of 421 and 489 m, respectively (Plate 1, fig. 7). A large number of serpent stars (Ophiuroidea) is recognised on the surface of the sites G-9 to -12 (Plate 1, fig. 6). Olive grey homogeneous mud is distributed at the sites G-13 to -17 in the middle to lower slope area at water depths from 761 to 1,748 m (Plate 1, fig. 8 and Plate 2, figs. 1, 2 and 3). Dark grey sticky and compact mud underlies the olive grey homogeneous mud, about five centimetres thick, at the site G-13. Reddish brown soupy mud layer less than 1 cm thick are recognised on the sediment surface of the sites G-16 and -17 (Plate 2, fig. 3). The surface sediments of the furthest site G-18 at a water depth of 1,558 m consist of yellowish olive compact and markedly sticky mud (Plate 2, fig. 4). In addition, although the site G-18 is the furthest on the survey line and the slope continues north-northwestward to the deepest part of the Kurile Basin on the bathymetric charts (*e. g.* Hydrographic

Table 1: Results of sampling on the R. V. *Tansei-maru* Cruise KT01-14 in the southwestern part of the Okhotsk Sea off Abashiri, Hokkaido and the northeastern marginal part of the Japan Sea northwest off Shakotan, Hokkaido (6-m PC: 6-m-long piston core sampler, Okean L: Okean grab sampler, Okean-H: Okean grab sampler with extra weights).

| Station | Locality | Date (D/M/Y) | Sampler | Time hit | Longitude (E: d. m.) | Latitude (N: d. m.) | Water depth (m) | Recovery (%) or core length (cm) | Sediment type |
|---|---|---|---|---|---|---|---|---|---|
| KT01-14 G-3 | off Abashiri | 20/09/01 | Okean L | 13:53 | 144 34.735 | 43 58.032 | 49 | 60 % | molluscan shell bearing gravelly coarse- to very coarse-grained sand |
| KT01-14 G-4 | off Abashiri | 20/09/01 | Okean L | 13:08 | 144 37.235 | 44 01.242 | 72 | 30 % | molluscan shell, shell fragment, and pebble-gravel bearing medium- to coarse-grained sand |
| KT01-14 G-5 | off Abashiri | 20/09/01 | Okean H | 12:34 | 144 37.513 | 44 02.869 | 99 | 30 % | molluscan shell, shell fragment, and pebble-gravel bearing medium- to coarse-grained sand |
| KT01-14 G-6 | off Abashiri | 20/09/01 | Okean H | 12:10 | 144 37.224 | 44 03.625 | 117 | 20 % | molluscan shell, shell fragment, and pebble-gravel bearing medium- to coarse-grained sand |
| KT01-14 G-7 | off Abashiri | 20/09/01 | Okean H | 11:51 | 144 36.916 | 44 04.355 | 142 | 30 % | pumice bearing scoriaceous medium-grained sand |
| KT01-14 G-8 | off Abashiri | 20/09/01 | Okean H | 11:22 | 144 37.076 | 44 04.627 | 174 | 20 % | molluscan shell bearing pumiceous and scoriaceous medium-grained sand |
| KT01-14 G-9 | off Abashiri | 20/09/01 | Okean H | 10:46 | 144 37.208 | 44 04.903 | 193 | 40 % | pale olive grey pumiceous and scoriaceous fine- to medium-grained sand, serpent stars on the surface |
| KT01-14 G-10 | off Abashiri | 20/09/01 | Okean H | 10:09 | 144 37.992 | 44 06.214 | 250 | 40 % | pale olive grey scoriaceous muddy sand, soft surface, serpent stars on the surface |
| KT01-14 G-11 | off Abashiri | 20/09/01 | Okean H | 09:24 | 144 38.905 | 44 07.753 | 423 | 60 % | olive grey homogeneous sandy mud, soft surface, a large nember of serpent stars on the surface |
| KT01-14 G-12 | off Abashiri | 20/09/01 | Okean H | 08:40 | 144 38.689 | 44 08.188 | 493 | 50 % | olive grey homogeneous sandy mud, soft surface, a large number of serpent stars on the surface |
| KT01-14 G-13 | off Abashiri | 20/01/01 | Okean H | 07:49 | 144 39.731 | 44 11.403 | 761 | 80 % | olive grey homogeneous soft mud in the upper, dark olive sticky mud in the lower |
| KT01-14 G-14 | off Abashiri | 20/09/01 | Okean H | 05:43 | 144 41.555 | 44 15.364 | 1,004 | 0 % | *no recovery* |
| KT01-14 G-14' | off Abashiri | 20/01/01 | Okean H | 06:25 | 144 41.768 | 44 15.398 | 1,017 | 100 % | olive grey homogeneous mud, fical pellets bearing soupy mud on the surface |
| KT01-14 G-15 | off Abashiri | 20/09/01 | Okean L | 00:03 | 144 43.033 | 44 18.533 | 1,270 | 70 % | olive grey homogeneous mud, yellowish grey soft mud of the surface |
| KT01-14 G-16 | off Abashiri | 21/09/01 | Okean L | 01:59 | 144 47.482 | 44 28.122 | 1,540 | 70 % | olive grey homogeneous mud, slightly brownish soft mud on the surface |
| KT01-14 G-17 | off Abashiri | 21/09/01 | Okean L | 03:52 | 144 50.573 | 44 35.817 | 1,748 | 60 % | olive grey homogeneous mud, reddish brown soft mud on the surface |
| KT01-14 G-18 | off Abashiri | 21/09/01 | Okean L | 06:03 | 144 52.872 | 44 46.050 | 1,558 | 50 % | yellowish olive compact mud, pale yellow mud on the surface |
| KT01-14 P-1 | off Abashiri | 21/09/01 | 6-m PC | 08:55 | 144 49.719 | 44 35.260 | 1,715 | 520 cm | olive green mud in the upper, olive grey compact mud in the lower |
| KT01-14 G-19 | off Shakotan | 23/09/01 | Okean L | 17:17 | 140 37.800 | 43 20.935 | 125 | 30 % | compact brownish olive muddy fine-grained sand |
| KT01-14 G-20 | off Shakotan | 23/09/01 | Okean L | 17:40 | 140 38.622 | 43 21.500 | 158 | 20 % | gravel bearing sticky brownish olive muddy sand |
| KT01-14 G-21 | off Shakotan | 23/09/01 | Okean L | 18:04 | 140 38.958 | 43 21.661 | 178 | 30 % | *no recovery* |
| KT01-14 G-21' | off Shakotan | 23/09/01 | Okean L | 18:17 | 140 39.081 | 43 21.641 | 182 | 20 % | olive grey homogeneous muddy sand, serpent stars on the surface |
| KT01-14 G-22 | off Shakotan | 23/09/01 | Okean L | 18:38 | 140 39.525 | 43 21.897 | 210 | 40 % | olive grey homogeneous muddy sand, serpent stars on the surface |
| KT01-14 G-23 | off Shakotan | 23/09/01 | Okean L | 19:04 | 140 39.708 | 43 22.272 | 252 | 40 % | olive grey homogeneous muddy sand, serpent stars on the surface |
| KT01-14 G-24 | off Shakotan | 23/09/01 | Okean L | 19:44 | 140 40.315 | 43 23.417 | 368 | 60 % | olive grey homogeneous muddy sand / sandy mud |
| KT01-14 G-25 | off Shakotan | 23/09/01 | Okean L | 20:31 | 140 41.411 | 43 24.708 | 528 | 90 % | olive grey homogeneous mud |

Department, 1980), the water depth of the site is about 150 m shallower than that of the site G-17. Cored sediments KT01-14 P-1, about 520 cm long, obtained from the lower slope of the Kurile Basin at a water depth of 1,715 m is composed mainly of olive grey homogeneous mud, judged from the horizontal cutting surfaces.

### 2. Continental Shelf and Slope in Northeast Japan Sea off Shakotan

In the continental shelf north-northwest off Shakotan in the northeastern marginal part of the Japan Sea, and the southern slope of the Ishikari Basin, surface sediments are composed mainly of brownish olive muddy fine-grained sand in the shallowest site G-19 at a water depth of 125 m (Plate 2, fig. 5), and pebble- to cobble-gravel-bearing brownish olive muddy sand in the site G-20 at a water depth of 158 m (Plate 2, fig. 6). The surface sediments at the site G-21 to -24 in the shelf edge and the continental slope areas at water depths of 182 to 368 m are composed of olive grey homogeneous muddy sand or sandy mud (Plate 2, fig. 7). A large number of serpent stars (Ophiuroidea) is recognised on the surface of the sites G-21, -22 and -23. Olive grey homogeneous mud was recovered from the deepest site G-25 on the survey line at a water depth of 528 m in the slope area (Plate 2, fig. 8).

## 5. DISCUSSION

A limited number of marine geological studies has been made in the southern part of the Okhotsk Sea, since intergovernmental tension had mounted in the area up to recent years. After its relaxation, Ikehara (2002) carried out systematic surface sediment sampling in the southwestern part of the sea which includes the area of the present study, but his spatial grid-sampling bearing no relation with water-depths is insufficient for sedimentological and micropalaeontological studies in the shallow-sea area, because it is well known that spatial distribution of benthic micro-organisms is in close association with both water-depth and bottom sediment types. Although sediment sampling of the present study was carried out along only one line off Abashiri, and observation of the samples was short of a preliminary perception on their compositional features, a sufficient number of samples was recovered from various water-depths shallower than 200 m for further micropalaeontological and sedimentological studies. As described above a clear fining of surface sediments was recognised among the samples as water deepens.

On the other hand, despite the Geological Survey of Japan made systematic surface sediment sampling in the northeastern marginal part of the Japan Sea (*e. g.* Ikehara and Okamura, 1999, 2000), no surface sediments were collected from the area around the Shakotan Peninsula. Judging from the ocean current system off Southwest Hokkaido where a branch of the Tsushima Warm Current flows over the Japan Sea Proper Water along the coast, it is inferred that spatial distribution of benthic micro-organisms inhabiting in the area provides important information to understand the vertical water mass structure and its seasonal fluctuation in the area. Bottom samples both deeper than 528 m and shallower than 125 m were not recovered from the area due to the stormy weather during the survey, but the samples from the outer shelf to the middle slope were obtained successfully. However, the bottom sediment types among four samples obtained from 182 to 368 m deep show no marked sedimentological differences such as in grain-size and colour.

The surface sediment samples obtained from both southwestern marginal part of the Okhotsk Sea off Abashiri and northeastern marginal part of the Japan Sea off Shakotan hold out a promising prospect for investigations of micro-organisms inhabiting in these areas.

## 6. CONCLUDING REMARKS

The preliminary results from sediment sampling on the R. V. *Tansei-maru* KT01-14 cruise in the southwestern marginal part of the Okhotsk Sea and the northeastern marginal part of the Japan Sea are summarized as follows:

1. Surface sediments of the southwestern marginal part of the Okhotsk Sea off Abashiri are composed generally of molluscan shells-, shell fragments- and gravel-bearing medium- to coarse-grained sand in the inner shelf (49 to 127 m), pumiceous and/or scoriaceous fine- to medium-grained sand or sandy mud in the middle to shelf-edge through outer shelf (142 to 250 m), olive grey homogeneous sandy mud in the upper slope (421 and 489m), and olive grey homogeneous mud in the middle to lower slope (761 to 1,748 m).
2. Surface sediments of the northeastern marginal part of the Japan Sea off Shakotan consist mainly of muddy fine-grained sand in the middle shelf (125 m), gravel-bearing muddy sand in the outer shelf (158 m), olive grey homogeneous muddy sand and/or sandy mud in the outer shelf (182 to 368 m), and olive grey homogeneous mud in the middle slope (528 m).
3. A cored sediment, about 520 cm long, recovered successfully from the southwestern marginal part of the Okhotsk Sea at a water depth of 1,715 m is mainly composed of olive grey homogeneous mud.
4. The surface sediment samples collected with attention to the water-depths from both southwestern part of the Okhotsk Sea and northeastern marginal part of the Japan Sea during the cruise provide important material for micropalaeontological studies in these areas.

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# オホーツク海南西端部ならびに日本海北東端部における淡青丸 KT01-14 次航海の採泥結果

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## 要　旨

2001年9月17日～24日に実施されたオホーツク海南西端部の北海道網走市沖および日本海北東縁部の積丹半島沖での海洋研究船淡青丸の研究航海 KT 01-14 において，網走市沖オホーツク海域から16点の海底表層試料および1点の海底柱状試料が，また積丹半島沖日本海域から7点の海底表層堆積物がそれぞれ採取された．

網走市沖オホーツク海の海底表層堆積物は，内部陸棚域では貝殻や貝殻片，そして礫をともなう中～粗粒砂，中～外部陸棚域では軽石質あるいはスコリア質の細～中粒砂，上部斜面域では緑灰色の砂質泥，そして中～下部斜面域では緑灰色の泥からそれぞれ構成される．一方，積丹半島沖日本海の海底表層堆積物は，中部陸棚域では泥質細粒砂，外部陸棚域では含礫泥質砂，そして中部斜面域では緑灰色泥からそれぞれ構成される．

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## Explanation of Plate 1

The grab surface sediments recovered from the sea floor of the southwestern marginal part of the Okhotsk Sea off Abashiri, photographed immediate after the recovery (The sample bottle, 40 mm in diameter, gives scale).

fig. 1 : Molluscan shell-bearing, gravelly, coarse- to very coarse-grained sand at the site G-3, 49 m deep.

fig. 2 : Molluscan shells-, shell fragments- and pebble-gravel-bearing medium- to coarse-grained sand at the site G-4, 72 m deep.

fig. 3 : Molluscan shells, shell fragments and pebble-gravel-rich medium- to coarse-grained sand at the site G-5, 99 m deep.

fig. 4 : Molluscan shells, shell fragments and pebble-gravel-rich medium- to coarse-grained sand at the site G-6, 117 m deep.

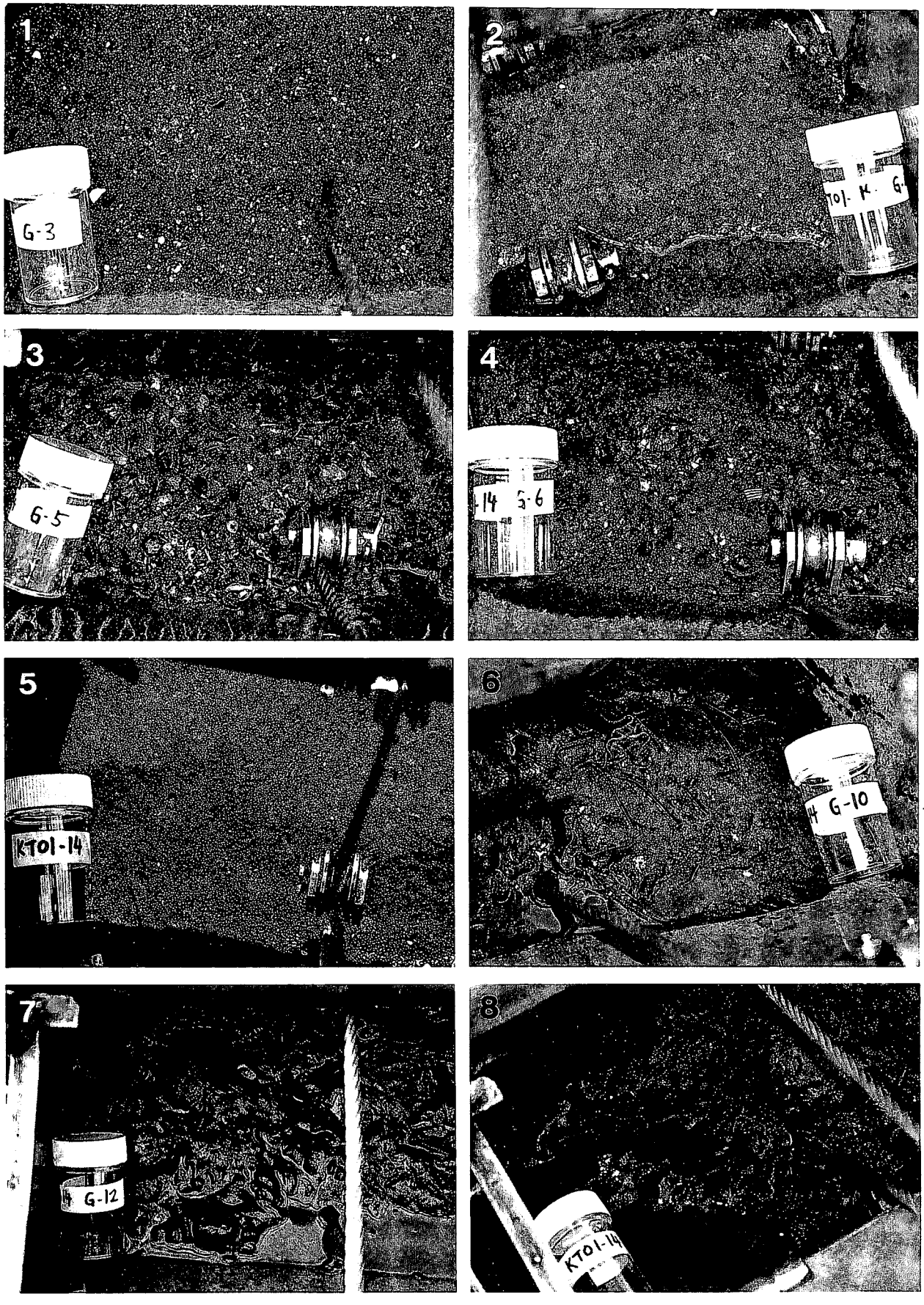
fig. 5 : Pumice-bearing scoriaceous medium-grained sand at the site G-7 at a water depth of 142 m.

fig. 6 : Pale olive grey scoriaceous muddy sand at the site G-10 at a water depth of 250 m. A large number of serpent stars are seen on the surface.

fig. 7 : Olive grey homogeneous sandy mud at the site G-12, 493 m deep. A large number of serpent stars on the surface.

fig. 8 : Olive grey homogeneous mud at the site G-13, 761 m deep.

**Plate 1**



## Explanation of Plate 2

The grab surface sediments recovered from the sea floor of the southwestern marginal part of the Okhotsk Sea off Abashiri (figs. 1 to 4) and in the northeastern marginal part of the Japan Sea off Shakotan (figs. 5 to 8), photographed immediate after the recovery (The sample bottle, 40mm in diameter, gives scale).

fig. 1 : Olive grey homogeneous mud at the site G-14', 1,017 m deep.

fig. 2 : Olive grey homogeneous mud at the site G-15, 1,270 m deep. Yellowish grey soupy mud on the surface.

fig. 3 : Olive grey homogeneous mud at the deepest site G-17, 1,748 m deep. Reddish brown soupy mud on the surface.

fig. 4 : Yellowish olive compact mud at the site G-18, 1,558 m deep. Pale yellow soupy mud on the surface.

fig. 5 : Brownish olive muddy fine-grained sand at the site G-19 at a water depth of 125 m.

fig. 6 : Pebble- and cobble-gravel-bearing brownish olive muddy sand at the site G-20, 158 m deep.

fig. 7 : Olive grey homogenous muddy sand at the site G-23, 252 m deep. A small number of serpent stars are seen on the surface.

fig. 8 : Olive grey homogenous mud at the site G-25, 528 m deep.

**Plate 2**